

Claims

23. A process for treating waste water which is highly loaded with ammonium at a level of at least about 200 mg/liter comprising treating the waste water with nitrifying microorganisms in the presence of suspended silicate carrier substance, wherein the silicate carrier substance has a specific surface area greater than about 20 m²/g, wherein the silicate carrier substance has a swelling volume of about 5 to about 80 ml/2g, wherein the silicate carrier substance acts as a carrier for the nitrifying microorganisms and wherein the silicate carrier substance with the nitrifying microorganisms is suspended in the waste water.

24. The process of Claim 23, wherein the specific surface area of the silicate carrier substance is greater than about 50 m²/g.

25. The process of Claim 23, wherein at least 95 percent of the silicate carrier substance has a particle size less than about 150 µm.

26. The process of Claim 23, wherein the waste water has an ammonium / nitrogen content of about 200 to 2000 mg/liter.

27. The process of Claim 23, wherein the waste water has an ammonium / nitrogen content of about 400 to 1600 mg/liter.

5 28. The process of Claim 23, wherein the waste water
is selected from the group consisting of municipal waste
waters, flow from a sludge treatment plant, supernatant
water from sludge digestion and waste dump leakage water and
mixtures thereof.

10 29. The process of Claim 23, further comprising
impregnating the silicate carrier substance with the
nitrifying microorganisms prior to its addition to the waste
water.

15 30. The process according to Claim 23, wherein a
denitrifying process is carried out under anoxic conditions.

31. The process of Claim 23, wherein the silicate
carrier substance comprises about 5 to 50 grams per liter of
the waste water.

20 32. The process according to Claim 23, wherein the
silicate carrier substance has a surface pH of about 6 to 9.

33. The process of Claim 23, wherein the silicate
carrier substance comprises a clay mineral.

34. The process of Claim 33, wherein the clay mineral
comprises a smectite clay.

25 35. The process of Claim 23, wherein during treatment
with the nitrifying microorganisms, the pH value of the
waste water is adjusted to about 6.5 to about 8.5 by the
addition of an alkali material.

5 36. The process of Claim 23, wherein the amount of the silicate carrier substance added to the waste water is from about 6 to about 15 kg per kg of nitrogen in the waste water.

10 37. The process of Claim 23, wherein the nitrification is carried out under aerobic conditions.

 38. The process of Claim 23 further comprising nitrifying the waste water by introducing an oxygen-containing gas to the waste water.

15 39. The process of Claim 38, wherein the oxygen content of the waste water is adjusted to be at least about 2 mg per liter of waste water.

20 40. The process of Claim 23, further comprising adjusting the nitrogen content of the waste water to a volumetric loading of about 0.5 to about 2.5 kg of ammonium nitrogen per m³ waste water.

 41. The process of Claim 23, further comprising reducing the Chemical Oxygen Demand level from at least about 300 to about 100 mg/liter before nitrification.

25 42. The process of Claim 23, wherein the NH₄ / nitrogen content is limited to a maximum value of about 1200 mg/liter before nitrification.

 43. The process of Claim 23, wherein the nitrifying microorganisms comprise ammonium-oxidizing bacteria.

5 44. The process of Claim 29, wherein a source for the
nitrifying microorganisms comprises a carbon-based product.

45. The process of Claim 33, wherein the clay mineral
comprises a bentonite clay.

10 46. The process of Claim 23 wherein the silicate
carrier substance has a cation exchange capacity (CEC) of
about 40 to 100 mVal/100 g.

47. The process of Claim 23 wherein the silicate
carrier substance has a cation exchange capacity (CEC) of
about 50 to 80 mVal/100 g.

15 48. The process of Claim 23 wherein the swelling
volume of the silicate carrier substance is from about 10 to
about 20 ml/2g.

20 49. The process of Claim 23 further comprising
denitrifying the waste water with denitrifying
microorganisms.

25 50. A process for treating waste water, which is
highly loaded with ammonium at a level of at least about
200mg/liter, comprising treating the waste water with a
nitrifying microorganism in the presence of a finely divided
carbon-containing substance selected from the group
consisting of activated charcoal, lignite, coke, coke dust,
anthracite, graphite, carbon black and mixtures thereof.

51. The process of Claim 50 wherein the carbon-

5 containing substance has a surface pH of about 6 to about 9.

52. The process of Claim 50 wherein the carbon-containing substance has a surface pH of about 6.5 to about 8.

10 53. The process of Claim 50 wherein at least about 95 percent by weight of the carbon-containing material has a particle size less than about $400\mu\text{m}$.

54. The process of Claim 50 wherein from about 10 to about 30 g/l of the carbon-containing carrier substance are utilized for treating the waste water.